

## CLAIMS

What is claimed is:

- 1 1. An integrated circuit package comprising:  
2 an integrated circuit having sense inputs for a sensed tip signal and a  
3 sensed ring signal of a subscriber loop, wherein the integrated circuit  
4 generates a subscriber loop linefeed driver control signal in response to the  
5 sensed signals, wherein the linefeed driver does not reside within a same  
6 integrated circuit.
- 1 2. The integrated circuit package of claim 1 wherein the sensed tip signal  
2 includes first and second sampled tip voltages, wherein a difference between  
3 the first and second sampled tip voltages is proportional to the tip current,  
4 wherein the sensed ring signal includes first and second sampled ring  
5 voltages, wherein a difference between the first and second sampled ring  
6 voltages is proportional to the ring current.
- 1 3. The integrated circuit package of claim 1 wherein the integrated circuit  
2 is a complementary metal oxide semiconductor (CMOS) integrated circuit.
- 1 4. A subscriber loop linefeed driver comprising:  
2 power circuitry for providing battery feed to a ring node and a tip node  
3 of a subscriber loop in accordance with a linefeed control signal; and

4 sense circuitry providing a sensed tip signal and a sensed ring signal,  
5 wherein the sensed tip and ring signals correspond to a tip current and a ring  
6 current of the subscriber loop.

1 5. The subscriber loop linefeed driver of claim 4 wherein the sense  
2 circuitry comprises:

3 a tip resistor series-coupled to the tip node and the power circuitry;

4 a pair of tip sampling resistors one end of each tip sampling resistor  
5 connected to opposite ends of the tip resistor, the other end of each tip  
6 sampling resistor forming a tip sense node;

7 a ring resistor series-coupled to the ring node and the power circuitry;

8 a pair of ring sampling resistors one end of each ring sampling resistor  
9 connected to opposite ends of the ring resistor, the other end of each ring  
10 sampling resistor forming a ring sense node.

1 6. The subscriber loop linefeed driver of claim 4 wherein the sensed tip  
2 signal comprises first and second sampled tip voltages, wherein a difference  
3 between the first and second sampled tip voltages is proportional to the tip  
4 current, wherein the sensed ring signal includes first and second sampled  
5 ring voltages, wherein a difference between the first and second sampled ring  
6 voltages is proportional to the ring current.

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1 7. The subscriber loop linefeed driver of claim 4 wherein the power  
2 circuitry comprises:  
3 a tip control circuit, wherein the tip control circuit increases a tip node  
4 voltage in response to a first tip control signal, wherein the tip control circuit  
5 decreases a tip node voltage in response to a second tip control signal; and  
6 a ring control circuit wherein the ring control circuit increases a ring  
7 node voltage in response to a first ring control signal, wherein the ring  
8 control circuit decreases a ring node voltage in response to a second ring  
9 control signal.

1 8. The subscriber loop linefeed driver of claim 7 wherein the tip control  
2 circuit comprises:  
3 a first transistor of a first type having an emitter coupled to receive the  
4 first tip control signal;  
5 a second transistor of the first type having an emitter coupled to  
6 receive the second tip control signal, wherein a base of each of the first and  
7 second transistors is coupled to first node;  
8 a third transistor of a second type having a collector coupled to a  
9 collector of the first transistor and an emitter coupled to a second node;  
10 a resistor having a first end coupled to the second node, a second end of  
11 the resistor coupled to a base of the third transistor and a collector of the  
12 second transistor.

1 9. The subscriber loop linefeed driver of claim 8 wherein the first type is a  
2 PNP bipolar junction transistor, wherein the second type is an NPN bipolar  
3 junction transistor.

1 10. The subscriber loop linefeed driver of claim 4 further comprising:  
2 voiceband circuitry for bi-directional communication of voiceband data  
3 between the ring and tip nodes and a voiceband data interface, wherein the  
4 voiceband circuitry provides the analog voiceband data interface with d.c.  
5 isolation from the ring and tip nodes.

1 11. The apparatus of claim 10 wherein the voiceband circuitry further  
2 comprises:  
3 a first voiceband data output node;  
4 a load coupled to the first voiceband data output node;  
5 a first voiceband data input node, wherein the load and the first  
6 voiceband data input node are capacitively coupled to a selected one of the tip  
7 and ring nodes.

1 12. The apparatus of claim 4 further comprising voiceband circuitry for  
2 bi-directional communication of voiceband data between the ring and tip  
3 nodes and a voiceband data interface, wherein the voiceband circuitry further  
4 comprises:  
5 a first voiceband data input node capacitively coupled to a selected one  
6 of the ring and tip nodes for receiving voiceband data from the subscriber

loop, wherein voiceband data transmitted to the subscriber loop is superimposed on the linefeed control signals.

1 13. An apparatus comprising:  
2 an integrated circuit generating subscriber loop control signals in  
3 response to a sensed tip signal and a sensed ring signal of a subscriber loop;  
4 and  
5 a linefeed driver for driving a subscriber loop in accordance with the  
6 subscriber loop control signals, the linefeed driver providing the sensed tip  
7 and ring signals.

1 14. The apparatus of claim 13 wherein the integrated circuit is a  
2 complementary metal oxide semiconductor (CMOS) integrated circuit.

1 15. The apparatus of claim 13 wherein the linefeed driver comprises:  
2 power circuitry for providing battery feed to a ring node and a tip node  
3 of a subscriber loop in accordance with a linefeed control signal; and  
4 sense circuitry providing a sensed tip signal and a sensed ring signal,  
5 wherein the sensed tip and ring signals correspond to a tip current and a ring  
6 current of the subscriber loop.

1 16. The linefeed driver of claim 15 wherein the sense circuitry comprises:  
2 a tip resistor series-coupled to the tip node and the power circuitry;

3 a pair of tip sampling resistors one end of each tip sampling resistor  
4 connected to opposite ends of the tip resistor, the other end of each tip  
5 sampling resistor forming a tip sense node;

6 a ring resistor series-coupled to the ring node and the power circuitry;

7 a pair of ring sampling resistors one end of each ring sampling resistor  
8 connected to opposite ends of the ring resistor, the other end of each ring  
9 sampling resistor forming a ring sense node.

17. The linefeed driver of claim 15 wherein the sensed tip signal comprises first and second sampled tip voltages, wherein a difference between the first and second sampled tip voltages is proportional to the tip current, wherein the sensed ring signal includes first and second sampled ring voltages, wherein a difference between the first and second sampled ring voltages is proportional to the ring current.

1 18. The linefeed driver of claim 15 wherein the power circuitry comprises:  
2 a tip control circuit, wherein the tip control circuit increases a tip node  
3 voltage in response to a first tip control signal, wherein the tip control circuit  
4 decreases a tip node voltage in response to a second tip control signal; and  
5 a ring control circuit wherein the ring control circuit increases a ring  
6 node voltage in response to a first ring control signal, wherein the ring  
7 control circuit decreases a ring node voltage in response to a second ring  
8 control signal.

1 19. The linefeed driver of claim 18 wherein the tip control circuit  
2 comprises:  
3 a first transistor of a first type having an emitter coupled to receive the  
4 first tip control signal;  
5 a second transistor of the first type having an emitter coupled to  
6 receive the second tip control signal, wherein a base of each of the first and  
7 second transistors is coupled to first node;  
8 a third transistor of a second type having a collector coupled to a  
9 collector of the first transistor and an emitter coupled to a second node; and  
10 a resistor having a first end coupled to the second node, a second end of  
11 the resistor coupled to a base of the third transistor and a collector of the  
12 second transistor.

1 20. The linefeed driver of claim 19 wherein the first type is a PNP bipolar  
2 junction transistor, wherein the second type is an NPN bipolar junction  
3 transistor.

1 21. The linefeed driver of claim 15 further comprising:  
2 voiceband circuitry for bi-directional communication of voiceband data  
3 between the ring and tip nodes and a voiceband data interface, wherein the  
4 voiceband circuitry provides the analog voiceband data interface with d.c.  
5 isolation from the ring and tip nodes.

1 22. The linefeed driver of claim 21 wherein the voiceband circuitry further  
2 comprises:  
3 a first voiceband data output node;  
4 a load coupled to the first voiceband data output node; and  
5 a first voiceband data input node, wherein the load and the first  
6 voiceband data input node are capacitively coupled to a selected one of the tip  
7 and ring nodes.

1 23. The apparatus of claim 15 further comprising voiceband circuitry for  
2 bi-directional communication of voiceband data between the ring and tip  
3 nodes and a voiceband data interface, wherein the voiceband circuitry further  
4 comprises:  
5 a first voiceband data input node capacitively coupled to a selected one  
6 of the ring and tip nodes for receiving voiceband data from the subscriber  
7 loop, wherein voiceband data transmitted to the subscriber loop is  
8 superimposed on the linefeed control signals.